Topic: Introduction to derivatives

Question: Which of the following statements is true?

Answer choices:

A The derivative of a function is the reciprocal slope at a point on the function.

B The derivative of a function is the rate of change at a point on the function.

C The derivative of a function is the y-intercept of a function.

D The derivative of a function is the x-intercept of a function.

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Solution: B

The derivative of a function is the rate of change at a point on the function.

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Topic: Introduction to derivatives

Question: Which of the following statements is true?

Answer choices:

A The definition of the derivative is $f'(a) = \lim_{x \to a} \frac{f(x) - f(a)}{x - a}$ or $f'(a) = \lim_{h \to 0} \frac{f(a + h) - f(a)}{h}$.

B The definition of the derivative is $m = \frac{\Delta y}{\Delta x}$.

C The definition of the derivative is $m = \frac{f(x_2) - f(x_1)}{x_2 - x_1}$.

D The definition of the derivative is $f'(a) = \lim_{x \to h} \frac{f(x) - f(a)}{h}$.

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Solution: A

The definition of a derivative is

$$f'(a) = \lim_{x \to a} \frac{f(x) - f(a)}{x - a}$$

or

$$f'(a) = \lim_{h \to 0} \frac{f(a + h) - f(a)}{h}$$

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Topic: Introduction to derivatives

Question: Use the definition to give the derivative of the function at $(1,0)$. Do not simplify your answer.

$$f(x) = x^4 - 1$$

Answer choices:

A $$f'(1) = \lim_{x \to 1} \frac{x^4 - 1 - 0}{x}$$

B $$f'(1) = \lim_{x \to 1} \frac{x^4 - 0}{x - 1}$$

C $$f'(1) = \lim_{x \to 1} \frac{x^4 - 1 - 0}{x - 1}$$

D $$f'(1) = \lim_{x \to 1} \frac{x^4 - 0}{x}$$

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Solution: C

The definition of a derivative is

$$f'(a) = \lim_{x \to a} \frac{f(x) - f(a)}{x - a}$$

or

$$f'(a) = \lim_{h \to 0} \frac{f(a + h) - f(a)}{h}$$

To show the derivative of $f(x) = x^4 - 1$ at $(1,0)$ using the definition of the derivative without simplifying, simply plug the given information into the formula

$$f'(a) = \lim_{x \to a} \frac{f(x) - f(a)}{x - a}$$

In this case, $a = 1$ and $f(a) = f(1) = 0$.

$$f'(1) = \lim_{x \to 1} \frac{x^4 - 1 - 0}{x - 1}$$

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